

*PSYCHOLINGUISTICS DISCOVERS THE OPERANT: A  
REVIEW OF ROGER BROWN'S A FIRST LANGUAGE:  
THE EARLY STAGES<sup>1</sup>*

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Brown's book is selectively reviewed with the aim of noting points of similarity between Brown's psycholinguistic analysis of language acquisition and a functional analysis of verbal behavior. Brown divides early language acquisition into five stages, based on mean length of utterance in samples of child speech. His book concentrates on Stage I, when mean length of utterance first rises above 1.0, indicating that children are beginning to speak in multi-morphemic utterances, and Stage II, when mean length of utterance in morphemes is about 2.25. Multi-morphemic utterances in Stage I consist mainly of ordered sequences of uninflected nouns and verbs, the order being that of the simple declarative sentence (agent-action-indirect object-direct object-locative). The review attempts a theoretical analysis of the functional stimulus control of Stage I syntactic order, concluding that the control must originate partly in relations among events in the environment and partly in covert autoclitic verbal behavior. Increases in mean length of utterance in Stage II are mainly due to the appearance of several "grammatical morphemes" such as the progressive *-ing* inflection on verbs and the plural *-s* inflection on nouns. The review attempts a behavioral paraphrase, again in terms of tacts and autoclitics, of Brown's psycholinguistic analysis of grammatical morphemes, concluding that Stage II displays the further development, building on Stage I, of the combined control of verbal behavior by relations in the environment and covert self-generated verbal stimuli. Similarities between Brown's psycholinguistic analysis and a functional analysis of language acquisition suggest that the two viewpoints are converging on a common concern with the stimulus control of verbal behavior.

In 1962, Roger Brown and his associates at Harvard<sup>2</sup> began their important long-term study of the development of syntax, or "morpheme combining", in children speaking American English. They selected for intensive study three children who were just beginning to speak in multi-word utterances, assigned them the fictitious Scriptural names Adam, Eve, and Sarah (no doubt to remind us that in the beginning was the Word), and took 30-min to 2-hr samples of their speech in their homes every week or two for at least a year

(Eve) and as long as 5 yr (Adam and Sarah). The immense quantity of naturalistic data so gathered has been under analysis ever since. In *A First Language*, Brown presents his most recent analyses of Stages I and II of syntactic development; a second book, covering Stages III to V, is promised.<sup>3</sup>

The "stages" were originally target points at which sample utterances first reached specified lengths. Stage I was the target point at which the mean length of utterance (MLU) first reached 1.75 morphemes and the upper bound on utterance length reached five morphemes. The corresponding target values for the later stages were: II (MLU 2.25, upper bound 7); III (2.75, 9); IV (3.50, 11); and V (4.00, 13). As near to each of these target values as he could get, Brown drew a sample

<sup>1</sup>Brown, Roger. *A first language: the early stages*. Cambridge, Massachusetts: Harvard University Press, 1973. Pp. XX + 437, \$15.00. Portions of this paper were presented as a colloquium to the Department of Psychology, University of California, San Diego, 30 May 1974. Reprints may be obtained from the author, Department of Psychology, San Diego State University, San Diego, California 92182.

<sup>2</sup>Samuel Anderson, Ursula Bellugi-Klima, Melissa Bowerman, Courtney Cazden, Gloria Cooper, Richard Cromer, Gordon Finley, Colin Fraser, Jean Berko Gleason, Camille Hanlon, David McNeill, Dan Slobin, and Esther Sorocka.

<sup>3</sup>Braine (1974) laments Brown's failure to include his full corpora on Adam, Eve, and Sarah along with his summary analyses. We are so far from having adequate data on the development of verbal behavior that we must, with Braine, hope that Brown intends eventually to publish his data in full.

of 713<sup>4</sup> consecutive complete utterances from the transcriptions for each child, and analyzed in detail the 15 samples (three children  $\times$  five stages) so obtained. By considering analyses of speech samples collected by 19 other investigators of the early speech of 41 other children speaking 12 languages (not only American English, but also Finnish, French, German, Hebrew, Japanese, Korean, Luo, Russian, Samoan, Spanish, and Swedish), Brown was able to expand the stages from points to intervals. Stage I, as broadly discussed in this book, covers the MLU range from just above 1.0, when multi-word utterances first appear, to 2.0. Stage II covers the MLU range from 2.0 to 2.50.

Brown argues persuasively the heuristic advantages of dividing the continuous development of speech into intervals demarcated by MLU, while making no claim that these are "true stages in Piaget's sense". As the child approaches linguistic maturity, the length of his utterances comes to be determined more and more by the subject under discussion and the kind of social interaction in which speech occurs, but before that, increases in MLU seem to reflect faithfully the child's grammatical progress: "[Increases in] the number of semantic roles expressed in a sentence, the addition of obligatory morphemes, coding modulations of meaning, the addition of negative forms and auxiliaries used in interrogative and negative modalities, and, of course, embedding and coordinating [a]ll alike have the common effect on the surface form of the sentence of increasing length" (pp. 53-54). Ease of calculating MLU is, of course, another of its virtues.

Brown says he and his colleagues had no difficulty deciding where one utterance ended and the next began, because one of the first things children master is the "intonational contours" of sentences (Menyuk, 1971), the changes in pitch and stress and other prosodic features that mark off one sentence from the next and that label it as declarative, interrogative, or imperative. The development of distinctive intonational contour in one-word utterances ("holophrases") is itself a worthwhile topic of study, for contour seems to be the first

"autoclitic" to appear in child speech. Distinctive pitch and stress patterns of course do not appear in the absence of the "phonemic topography" that distinguishes one verbal response from another, and they modulate the effect on the listener by indicating the modality of the response. This kind of modulation of more "basic" verbal responses functionally defines what Skinner (1957) called autoclitic verbal behavior, and an analysis of autoclitic development might well begin with the intonational contour of holophrases. Brown, however, was interested in "morpheme combining", and so his analysis begins when speech first ceases to be exclusively holophrastic.

### STAGE I

Utterances in Brown's Stage I are made up almost entirely of ordered sequences of uninflected nouns and verbs, and a few adjectives. The argument for treating Stage I two-word utterances as primitive sentences is not only that the utterances have the intonational contours of sentences, but also that the ordering of the component words is syntactically constrained. Brown says that the words are almost always ordered in just the way they should be to make simple declarative sentences that describe significant features of child experience. In simple declarative sentences, the order of terms is almost always: *agent - action - indirect object - direct object - locative*. This pattern yields adult sentences like "Mother gave John lunch in the kitchen", and briefer, though still relatively advanced, child sentences like "I ride horsie", "Tractor go floor", "Give doggie paper", and "Adam put it box". Even in Stage I, when utterances are rarely longer than two words, Brown says that multi-word utterances are almost always ordered in the grammatically correct declarative sequence. So there are two-word utterances that contain just agent and action: *Mommy fix*; or action and indirect object: *Give doggie*; or action and direct object: *Hit ball*; or agent and direct object: *Mommy pumpkin* (which Brown glosses as "Mommy is cutting a pumpkin"); or agent and locative: *Baby table* (Brown's gloss is "Baby is eating at a table"); or action and locative: *Put floor* ("Put it on the floor").

Brown's analysis of these two-word, Stage I utterances employs Lois Bloom's (1970)

<sup>4</sup>The odd number, 713, was an accidental consequence of the size of the transcriptions from which the first samples were drawn" (Brown, 1973, p. 56).

"method of rich interpretation". Brown notes that parents never hesitate to interpret the "semantic intentions" of their children's primitive utterances, basing their mature expansions or "glosses" on the "semantic relations" implied by the serial order of the words in the utterances and the environmental "context of reference" in which the utterances occur. With a certain defensiveness, Brown suggests that psychological investigators should follow the parental example. He contrasts this method of rich interpretation with "leaner", more "descriptive" methods of analysis applied earlier to the same data, and concludes that the "richer" interpretations are scientifically more productive. The operant behaviorist must wonder at Brown's defensiveness, for what Brown is advocating is a shift away from an exclusively structural analysis of verbal forms toward a functional analysis of verbal operants. "Semantic intentions" translates as control of verbal behavior by discriminative stimuli and reinforcing consequences. The control, however, is quite complex. When we say that a multi-word utterance constitutes a primitive sentence, we mean that the serial order of the component responses is not free to vary, but is determined as a functional unity; and the determination is not by isolated features of the environment, but by consequences uniquely correlated with *relations* among environmental events.

One must be skeptical of Brown's claim that most, if not all, of the child's first multi-word utterances are in grammatically correct declarative order. Although it is always possible, by the "method of rich interpretation", to come up with a grammatically correct adult expansion, there is no independent evidence that the expansion faithfully captures the child's "semantic intentions", that is, the true determinants of the observed word order. Still, at some point in the child's verbal development, whether in Stage I or later, the contingencies implicit in the English syntax of declarative sentences must contact the child's behavior and determine that when the relation the child responds to is between an agent and an action, the order of words will be agent-action (*Mommy fix*); and when the relation is between an action and its location, the order will be action-locative (*Put floor*). This is not to say that the sheer temporal order of events controls the temporal order of verbal

responses in a grammatical two-word utterance; more subtle relational dimensions control, in fact, the aspects we call agent-action, action-indirect object, agent-locative, and so on. It is remarkable that relations of such subtle dimensions ever come to control the order of verbal responses, but so it is. The complexity of relational stimulus dimensions does not make them less physical (see Attneave, 1974). Not only people, but other animals, too, can be brought to respond discriminatively and "contrastively" to such subtle stimulus relations as larger/smaller, more/fewer, first/last, similar/different, and novel/familiar, as the literature on infrahuman stimulus control testifies. Infrahuman, as well as human behavior, can be brought under the control of even conditional relations in the environment.<sup>5</sup> Much of the stimulus control of syntax probably involves conditional discriminations, but to say so much is not to exclude syntactical processes from the domain of behavior theory.

What is involved in the Stage I (or perhaps older) child's uttering in correct grammatical order the two verbal responses that describe a relation in the environment? Each of the two events that comprise the relation controls a separate verbal response of the sort Skinner (1957) called *tacts*. The child must first learn to tact the "agent" and separately the "action" in an agent-action relation. But this is not enough to explain the serial order of functionally unified utterances. The specific relation that is being tacted must also become a discriminative stimulus, controlling the order of emission of these simple tacts. If the specific relation is agent-action, the verbal response tacting the agent must be emitted first, and then the response tacting the action. (It may suffice, at the *two-word* utterance stage, if the order of emission of just the first response is controlled by the specific relation. The second response can then "tumble out", which is to say its serial position is completely determined—Skinner (1957) would say intraverbally—by the prior emission of the first response.) On the other hand, if the specific

<sup>5</sup>A nice example of verbal conditional discriminations appears in the film, "Teaching sign language to the chimpanzee, Washoe" (Gardner and Gardner, 1973). In the presence of a red shoe that belonged to Washoe, she variously signed the responses "Mine", "Red", and "Shoe" when queried, respectively, "Whose is that?", "What color is it?", and "What is it?".

relation tacted is action-direct object, the action-tact is no longer emitted second, but must now be first.

Of course the terms "agent", "direct object", and so on do not tact things but relations. A thing, say a dog, might at one time be an agent (*Dog bites boy*), at another time a direct object (*Boy bites dog*), at another time an indirect object (*Boy gives dog bone*), and at still another time a locative (*Boy finds flea on dog*). All of these subtle relations that a thing can enter into must become controlling stimuli for the child's verbal behavior before the specific pairing of relational events can control the order of emission of the simple verbal responses that directly tact the things themselves.

Nothing more than simple discriminative stimulus control need be involved in the evoking of tacts to the things themselves. Call tacts of this sort *primitives*. But a much more complex and conditional discrimination must be involved in the order of emitting the primitives. The conditional discriminations are of this sort: if a dog and biting are strong current stimuli, then if the dog is direct object of the dog-bite relation, the tact "bite" must be emitted first (read: only utterances in which "bite" is emitted first will be consistently and effectively reinforced). If the dog is agent of the dog-bite relation, the tact "dog" must be emitted first. Such conditional discriminations come under the heading of Skinner's (1957) *autoclitic* verbal behavior. An autoclitic is a *secondary* verbal response that is controlled, in part, by the prior strengthening of verbal primitives, and in part by other aspects of the environment. The kind of autoclitic we are talking about Skinner calls *relational*. The autoclitic ordering of the primitives is controlled partly by the "readiness" of two tacts, *dog* and *bite*, to be emitted, and partly by the relation between the dog and the biting. The final utterance tacts not only a dog and a biting, but, by the serial order of the responses, the relation between them.

There is something about this account that is unlike the typical operant account of behavior, and that is the assumption that the primitive tacts are "held in abeyance" until an autoclitic process has ordered them grammatically. Surely there must be an earlier stage in the development of children's verbal behavior when utterances are not ordered

grammatically, but rather the primitives issue forth in undetermined order (or in an order determined by factors simpler than syntax, such as temporal sequence). This may happen before Stage I, because Brown insists (although on weak evidence) that as soon as intonational contour permits segmentation of the speech stream into unmistakable two-word utterances, correct grammatical order is already evident in most, though not quite all, of the utterances. If Brown's contention is upheld by further research, it must mean that correct grammatical ordering of two-word utterances appears at the same time as the "enveloping" of the two-word utterance in the intonational contour of a sentence. "Ungrammatical" orders of two consecutive verbal responses would not be scored as such because the two verbal responses would be "enveloped" in separate intonational contours, and so treated as holophrases, to which the notion of syntactic order does not apply. According to Brown, by the time the child reaches Stage I, he has learned not to emit the two verbal responses that tact the two "arguments" of an environmental relation until they have been ordered by an autoclitic process, and "enveloped" in the appropriate intonational contour.

Consideration of the simplest level of "morpheme combining" behavior, then, forces the recognition of covert verbal processes, for autoclitic ordering by definition acts on primitive verbal responses that are *already available in some not-yet-emitted form*, albeit a form adequate to stimulate autoclitic ordering processes. The likely locus of autoclitic processes is a matter of controversy, and one must wonder whether it is prudent to presume a peripheral locus for autoclitic "behavior". As Skinner (1957, p. 371) put it: "Much of the self-stimulation required in the autoclitic description and composition of verbal behavior seems to occur prior to even subaudible emission. In both written and vocal behavior changes are made on the spur of the moment and so rapidly that we cannot reasonably attribute them to an actual review of covert forms." Lacking any basis for resolving questions about the locus of covert verbal (and other "cognitive") events, psychologists would better spend their energies on empirical studies than on metaphysical debate. The kind of empirical information we need will be recog-

nizable by its power to resolve rather than fuel controversy.

Another question concerning Stage I verbal behavior has to do with the priority of nonverbal stimulus control. Brown argues that the kinds of environmental relations that seem to control the ordering of multi-word utterances in Stage I are just the kinds of relations that acquire control of nonverbal behavior in the stage of child development Piaget (1952) called "sensori-motor intelligence". Brown, Piaget, and many other students of child behavior and of language (Premack, 1970, for instance) have argued that events in the environment must acquire discriminative control over nonverbal behavior before they can control verbal behavior. In cognitive terms, the organism must "have the concept" before he can learn to "name" it. That appears to describe Brown's Stage I language. The Stage I child is typically past 2 yr old, and is just beginning to tact the relations that had already gained control of his nonverbal behavior in the sensori-motor stage that is now ending.

But that does not imply that stimulus control of nonverbal behavior has a necessary priority over stimulus control of verbal behavior. It may simply be that the contingencies of reinforcement normally responsible for the development of the stimulus control of nonverbal behavior are more powerful than the contingencies responsible for the development of discriminative verbal behavior. More significant reinforcers may attend the child's learning to locate a toy, grasp it, carry it to his lips, and suck it than attend his learning to tact that sequence. If equally powerful reinforcers were brought to bear on his verbal behavior, there is no evident reason why he would not acquire the relevant discriminations verbally rather than nonverbally, or at least verbally before nonverbally. Surely adults, and children too, demonstrate the acquisition of verbal discriminations before the corresponding nonverbal discriminations whenever they profit from "observational learning" experiences. They may first describe the contingencies of a situation to themselves, and on that basis respond nonverbally. It is surely not the topography of response that is important, whether the behavior involves the limbs or the vocal musculature. What must be important are the kind and complexity of the stimulus events that acquire discriminative control of

behavior, and the kind of reinforcement contingencies that are brought to bear on discriminative learning.

## STAGE II

In Stage II, children's utterances typically become longer than two words, and other kinds of autoclitics in addition to word ordering begin to appear. Brown calls these new autoclitics "grammatical morphemes". The particular 14 grammatical morphemes Brown analyzed intensively are, in the order of their appearance in children's speech (and Brown, and deVilliers and deVilliers, 1973, have impressive evidence that the order of acquisition is roughly invariant over children acquiring English in the natural way): (1) The present progressive *-ing* inflection on verbs, making generic *go* into progressive *going*. (2) and (3) The locative prepositions *in* and *on* (these come in at the same time, so their rank order is 2.5). (4) The plural *-s* inflection on nouns. (5) Past irregular verbal inflections like *did*, *went*, *came*, and so on (Brown looked at a large set of them). (6) The possessive *'s* inflection on nouns. (7) The uncontractible copula *be* (in sentences like *Here I am* and *There it is*, the copula cannot be contracted). (8) The definite and indefinite articles *a* and *the*. (9) The past regular *-ed* inflection on verbs. (10) The third-person, present-tense regular verb inflection *-s* (*I talk* and *You talk* but *He talks*). (11) The third-person, present-tense irregular verb inflections *does*, *doesn't*, and *has*. (12) The uncontractible auxiliary *be* (the past tense form cannot be contracted. We must say *He was going*). (13) The contractible copula, as in *It's red*. (14) The contractible auxiliary *be*, as in *He's going*.

Brown calls these forms "grammatical morphemes" and Skinner (also see MacCorquodale, 1969, 1970) calls them "autoclitics". It is striking how closely Brown's and Skinner's explanations of their preferred terms correspond. Here is Skinner's introduction to autoclitics: "Part of the behavior of an organism becomes in turn one of the variables controlling another part . . . [The speaker] may hear himself or react to private stimuli associated with vocal behavior, possibly of a covert or even incipient form . . . These responses are in a sense similar to other tacts . . . but . . . [i]n the absence of any other verbal behavior

whatsoever autoclitics cannot occur . . ." (Skinner, 1957, Chapter 12). And here is Brown's introduction to grammatical morphemes: "[There is] some sort of distinction between the meanings the grammatical morphemes carry and the more 'basic' relational meanings of Stage 1 . . . [Grammatical morphemes] seem to 'tune' or 'modulate' the meanings associated with the contentives . . . the modulation is inconceivable without the more basic meanings" (pp. 249-253).

Brown's and Skinner's subsequent treatments of these grammatical responses are also similar. Brown provides an extensive and stimulating discussion of the "semantics" of his grammatical morphemes—the stimulus conditions that make them "obligatory" in certain linguistic contexts, and their role in clarifying for the listener what the speaker is saying. Skinner (1957) provides an equally extensive and stimulating, and basically similar discussion of the "stimulus control" of his autoclitics, and their role in modulating the listener's responses. Brown, being a "mentalist" and "intentionalist", talks about the child's "semantic intentions", where Skinner, being a "radical behaviorist", talks about the "stimulus control of the speaker's verbal behavior". One may be excused, however, for doubting the deep significance of this difference, for both theorists attempt roughly the same job, an analysis of the stimulus conditions under which certain classes of verbal responses appear in utterances, and their effects on listeners. (For my money, they do about equally good jobs of it, and they both fall short for the same reason: there aren't enough good data.)

#### BROWN (pp. 299-301)

A distinction is made between deep and surface structures. Deep structures are intended to include all the information needed for a semantic interpretation and surface structures the information needed by the phonological component. Deep structures are mapped into surface structures by meaning-preserving transformations.

. . . there are only two lexical classes that appear in deep structures: nouns and verbals . . .

. . . From nouns and verbals, segments, or bundles of features, are created by segment structure rules. These

Brown and Skinner also attempt "grammatical", as opposed to "semantic", analyses of these classes of verbal behavior, though the dividing line between the two kinds of analysis is very fuzzy, as both theorists know. For both, what a grammatical analysis amounts to is an analysis of the complex and largely covert *intraverbal* control of autoclitic responses (or grammatical morphemes). (Skinner, 1957, defined intraverbal responses as verbal responses under the stimulus control of prior verbal responses, the classical examples being the responses in "word association" norms and verbal "paired associate" learning.) What both theorists are concerned with are the "syntactic constraints" that generate such phenomena as "sentence frames" (Skinner and Brown both use the term), agreement in number and gender between subject and verb, and, of course, the order of words in a sentence.

Brown did not attempt to develop his own English grammar, but used the linguistic analysis of Jacobs and Rosenbaum (1968) which, Brown says, "follows Katz and Postal . . . and Chomsky". It will be instructive to compare Brown's version of Jacobs and Rosenbaum, which I take to be a reasonably faithful rendition of a transformational-generative linguistic grammar, with a paraphrase in "operantese". The paraphrase is not offered as an up-to-date behavioral analysis of grammar, but rather to make the point that there is an alternative way to talk about the same grammatical phenomena. I believe the two languages, the linguistic and the behavioral, are roughly equivalent; that is, they display comparable respect for the phenomenal complexities of grammatical processes.

#### OPERANT PARAPHRASE

"Deep structures" are the covert verbal responses that are controlled by external stimulus events. "Surface structures" are the overt responses that are emitted after autoclitic processes have modified the covert primitives. "Meaning-preserving transformations" are the autoclitic processes.

Primitive tacts to the generic properties of objects and primitive tacts to the generic properties of actions provide together the (intra)verbal part of the stimulus control of subsequent autoclitic responses.

Incidental features of objects and actions comprise the environmental part of the stimulus control of auto-

BROWN (pp. 299-301)—*continued*

rules introduce just those features which are not invariable features of particular nouns and verbals but rather occasional features: ( $\pm$ singular), ( $+$ progressive), ( $+$ present), and so on.

The feature content of segments is further specified by the introduction from the lexicon of items whose features are added to those generated by the segment structure rules.

. . . all [the grammatical morphemes] are derived in the same general fashion. Segments representing them are introduced by transformations which are triggered by the presence in noun and verbal segments of particular semantic features . . . Nouns and verbals have some features which have no surface representation, such features as ( $\pm$ animate), ( $\pm$ concrete). Presumably this is because these features are unchanging in a noun from one use to the next. But other features, those that are not unchanging in the noun, do have surface representation. These are the features introduced by segment structure rules: ( $\pm$ singular) affect the inflection of the noun; ( $\pm$ definite) affect the selection of articles; ( $\pm$ progressive) and ( $\pm$ present) affect the inflection of verbals. And still other features . . . affect the introduction of prepositions and copulas and of the other inflections. In the Jacobs-Rosenbaum grammar the 14 morphemes are introduced transformationally when nouns and verbals have their meanings modulated by the presence or absence of particular features.

In the Jacobs-Rosenbaum grammar lexical items are introduced at two points in a derivation rather than at one point as in most transformational grammars. The first 'lexical pass' occurs after the operation of segment structure rules but prior to the operation of any transformations. This is where lexical substitution usually occurs in a transformational grammar, but, since Jacobs and Rosenbaum use transformations to introduce all the segments (or feature-sets) underlying grammatical morphemes, it is necessary to provide for the substitution of words and affixes for these segments. And so there is a second lexical pass which follows after the operation of transformations and which primarily adds grammatical morphemes.

While Jacobs and Rosenbaum have written a grammar rather than a program simulating the psychological process of sentence construction it is possible that the two lexical passes belong in such a program and it is also possible that the second lexical pass is developmentally a later acquisition than the first. The first lexical pass would produce strings of nouns and verbals, the kind of string that would underlie Stage I telegraphic speech. The second lexical pass would introduce the grammatical morphemes which develop at various times after Stage I.

OPERANT PARAPHRASE—*continued*

clitic responses that modify or accompany primitive tacts.

Primitives must be strengthened first, and then the primitives can intraverbally strengthen autoclitic forms that modify the primitives.

Generic (unchanging, defining) properties of objects and actions control primitive (generic) tacts.

Incidental (variable) properties of objects and actions and relations among objects and actions control autoclitic response forms that tact incidental properties and relations. These forms do not appear as independent, isolated responses but as "inflections" or modifications or accompaniments of primitive responses. Plurality of objects controls the autoclitic modification of primitive objects-tacts by the addition of *-s*. Particularity of the object tacted (a relational property) controls the accompanying autoclitic *the*. Generality of the object tacted (an alternative relational property) controls the accompanying autoclitic *a*. Temporal properties of the action control autoclitic modification of action-tacts (often conditionally upon the "person" of the actor). *E.g.*, if stimuli in the environment mark the action as temporary, the autoclitic *-ing* modifies the primitive action tact. Environmental control of autoclitics always works in concert with intraverbal control supplied by the covert primitives.

Almost but not quite simultaneously with the strengthening of covert verbal primitives that tact generic features of objects and actions, incidental features begin to strengthen tact-like autoclitics.

The prior strengthening of the verbal primitives, in combination with the incidental features of the environment, completes the occasion for autoclitic responses that modify the primitives.

Children in Stage I emit strings of autoclitically ordered primitive tacts. Speakers beyond Stage I emit verbal responses that have been autoclitically modified in additional ways.

It should be clear from Brown's version of the Jacobs-Rosenbaum transformational grammar, and my version of an operant paraphrase, that both are speculative. We need experiments.

In the remainder of Brown's treatment of the grammatical morphemes, he attempts to analyze each of the morphemes individually, in terms of the complexity of their environmental and intraverbal stimulus control. What he is looking for are the determinants of the order of acquisition of the morphemes in the children's speech. He tries, as best he can on the *a priori* grounds of a plausible analysis, to order the semantic complexity of each morpheme, or, in other words, to rank the difficulty of the environmental discriminations that control it. He has a superb semantic analysis of the extremely complicated conditional discriminations involved in the correct usage of the English definite and indefinite articles. (Brown points out that native speakers of languages that have no articles—Japanese and Russian, for example—often do not master the discriminations involved in the use of English *a* and *the* if they first come to English as adults.) Brown also tries, as best he can on the *a priori* grounds of the Jacobs-Rosenbaum grammar, to order the grammatical complexity of each morpheme, or, in other words, to rank the difficulty of the intraverbal discriminations involved in the control of the relevant autoclitic processes. Then, he converts both sorts of complexity analysis to "cumulative complexity", on the reasonable argument that a discrimination involving two sets of conditionally related stimuli should be more difficult than a discrimination that involves only one of those stimulus sets. Finally, he rank-orders the morphemes in terms of cumulative semantic and cumulative grammatical complexity, and compares these rank orders with the rank order of acquisition. Both rank-order correlations are positive, significant, and high. Brown concludes: "In Stage II semantic complexity seems to do a better job of predicting order of acquisition than does grammatical complexity but, because there is considerable confounding of the two for the 14 English morphemes . . . the outcome must be considered indeterminate" (pp. 407-408).

It is important to note that whereas the rank-order correlations between cumulative semantic complexity and order of acquisition,

and between cumulative grammatical complexity and order of acquisition both were high, positive, and significant, the rank-order correlation between frequency of the various morphemes in the speech of the children's parents and the order of acquisition in the children's speech was very low and nonsignificant. Brown seems to think this should embarrass behavior theory, but it is not clear why. As Brown himself points out, some minimum frequency of the morphemes must exist in the parental language models the children are exposed to, or the children would have no possible basis for acquiring the morphemes. But beyond that minimum frequency, the difficulty of the relevant discriminations must surely be a more important determinant of the acquisition of autoclitics. Brown also notes that parents of young children seem to ignore grammatical errors in their children's speech. They seem to provide very little if any differential reinforcement for correct syntax, accepting anything the child says with grateful delight. Brown speculates that if reinforcement contingencies play a role in the acquisition of complex syntax, they must operate outside the home, when the child is speaking to listeners who are not so indulgent as his parents, and not so closely in touch with the everyday events of the child's life. Parents can "make sense" of even the Stage I child's two-word utterances, and even of his one-word agrammatical holophrases that appear before, and continue into, Stage I, because they know the child's history and his current circumstances well enough to make intelligent guesses about what stimuli are controlling his verbal responses from moment to moment. Strangers clearly cannot do that unless they are supplied with enough autoclitics to make the full circumstances explicit. Until further evidence is in, Brown's speculations about differential reinforcing contingencies operating inside and outside the home seem reasonable, and certainly offer no problems to a behavioral account. There is an alternative possibility, however, although it might be complementary to the first. Baldwin and Baldwin (1973) recorded the utterances of mothers and their children during half-hour free-play sessions, and found that while the syntactic complexity of mothers' utterances was always greater than that of their children's, the syntactic complexity of mothers'

utterances was graded according to their children's linguistic development. Mothers of younger children spoke to their children in sentences of less complexity than mothers of older children. This may indicate that mothers model particular syntactic forms as they judge that their children are "ready", at least to understand, if not to imitate them. The parental modelling "pressure" on the children to utter progressively more complex syntactic forms may operate even within the home. It is still not clear what differential social reinforcement contingencies the parents' verbal models may signal, or whether any *extrinsic* reinforcement contingencies at all are involved in the child's acquisition of syntax. As Brown points out, if parents understand well enough, and respond appropriately, to very primitive child utterances, what extrinsic incentives does the child have for increasing the complexity of his utterances? The answer may be that the prodigious feats of interpretation parents engage in are not so prodigious after all; closer analyses of parent-child interactions may reveal that fewer of the child's primitive utterances are effectively reinforced than we now believe, and that progressively more of them are reinforced as they approach the complexity of the adult models. Suppose closer analysis disclosed that many of the parents' interpretations and consequent responses to the child are wrong, and not what the child "intended"? The parent may respond, and the psychological observer may conclude that the child is "satisfied" by the parent's response, but the parent's incorrect (from the child's viewpoint) gloss, together with his consequent incorrect response to the child, may instruct the child what *not* to say on the next occasion. Finally, we should not overlook the possibility that as the child becomes attuned to greater syntactic complexity in the parent's speech, his own utterances of sentences that approximate the parent's are automatically self-reinforced. We cannot choose among these possibilities on the basis of current research.

Finally, what about "rules" of syntax? Brown insists that the children must be learning syntactical rules because their grammatical responses "generalize in just the ways that the rules describe" (p. 389). To be sure, one cannot explain all the utterances of children as rote-learned verbatim imitations of their parents (although some of them surely are; Brown

calls these "routines" and Skinner calls them "echoic" responses). Children do correctly generalize verbal responses to situations in which they have never emitted them before. Moreover, they combine echoically acquired "fragmentary" responses in novel, and syntactically appropriate ways in the presence of novel stimulus combinations.<sup>6</sup> If that is what Brown and other psycholinguists mean by "rule-learning", there is no disagreement with behavior theory. I think in fact that is what Brown means, for he makes clear at several places in his book that he does not think children, or adults either, are "aware" of the rules of English syntax, in the sense of being able to formulate them. As Brown says, it is the linguist's job to formulate the rules. Psychologists are free to employ the term "rule" in two different contexts: one is that explicitly formulated rules may function as verbal stimuli to govern behavior; the second is that reinforcement contingencies may generate generalized control over verbal responses. Whether it is wise to use the term in both these senses is another matter. The indiscriminate use of the term in both senses misses Skinner's (1969) useful distinction between, on

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<sup>6</sup>The most extensive experimental analysis to date of the generative combining of echoically acquired responses into syntactically appropriate, novel responses of larger size is the work on establishing the plural morpheme in retarded children (García, Guess, and Byrnes, 1973; Guess, 1969; Guess and Baer, 1973; Guess, Sailor, Rutherford, and Baer, 1968; Sailor, 1971). First, shaping and stimulus-control procedures established echoic responses to verbal stimuli supplied by the trainer in the presence of nonverbal stimuli. Then, a fading procedure shifted control of the response forms from the trainer's echoic stimuli to the nonverbal stimuli. In this way, several pairs of tact responses were established, for example, *hat* in the presence of one hat and *hats* in the presence of two hats. In addition, several tacts were established only in the singular form. After establishment of a sufficient number of related pairs of singular and plural tacts, differing only in the absence or presence, respectively, of the terminal form *-s*, presentation of novel pairs of stimuli for which only the singular tact had been established led to the generative combination of the "fragmentary" plural response *-s* with the relevant singular tact form. Thus, for example, *-s* might be combined with the singular tact *rock* to yield the generative plural tact, *rocks*, upon first exposure to a plural number of *rocks*. Note that the generative pluralization of tact responses must involve an autoclitic *ordering* process, because the *-s* and *rock* responses, for example, combined to yield *rocks*, not *srock*.

the one hand, "rule-governed" behavior, and on the other hand, "contingency-shaped" behavior. Explicit rules can (but do not necessarily) have the same effect on the behavior of a sophisticated organism as reinforcement contingencies, but the learning histories by which they acquire control are surely not the same. Cognitive psychologists like Brown speak as though the verbal organism possessed "knowledge" upon which he can draw to "express his meaning". For cognitive theorists, it is the organism who is in control, and one of Brown's expressed aims in this book is to trace the development of the child speaker's "control" over his "use" of syntactical "devices". The behavioral viewpoint makes the speaker a more passive creature of his environment. In behavior theory, the speaker does not "choose" to "use" a "word" to "express" a "meaning": he emits a verbal response under stimulus control arising from past contingencies of reinforcement. In fact, the "active" and the "passive" metaphors reflect aspects of the same reality. The child's behavior is passively under the control of present circumstances, but under these circumstances the child's verbal behavior actively alters the environment, and of course those consequences affect his future verbal behavior.

This difference in manner of speaking influences the direction of research on verbal behavior, the different kinds of data that behaviorists and psycholinguists collect, the different methods of collecting them, and the different conclusions drawn from them. Nevertheless, as I have tried to show, with just a little effort it often proves possible to paraphrase cognitive conclusions in behavioral terms, and then the conclusions often "make sense". I will not dwell on the epistemological implications of this unexpected convergence of disparate theoretical and pretheoretical viewpoints, but I do want to suggest that there is something of value in the current cognitive and psycholinguistic literature, even though some culling, some paraphrasing and interpreting, and some granting the benefit of the doubt, may be necessary to get at it. Roger Brown's book is a case in point.

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